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John Strong Newberry.

By N. L. Britton.

(With Portrait and Plate CXLII.)

Professor John Strong Newberry, president of this club for ten years, and one of the most eminent scientific men of our time, died at his residence in New Haven, Conn., during the night of December 7, 1892. He was stricken with paralysis on the 3d of December, 1890, and while he recovered from the attack so as to be able to return to his studies for a short time during 1891, his recuperation was at no time sufficient to allow him to exert himself for more than a few hours at a time. Only those who were closely associated with him can realize what a profound loss it was to the Club and to American science generally when he was taken ill, and his death leaves a void which we are sure can never be filled.

Professor Newberry was born at Windsor, Conn., on December 22, 1822. He was thus within about two weeks of being seventy years of age. His family moved to Ohio during his boyhood, and his father became interested in coal-mining, then a new industry in that part of the country. Dr. Newberry's first tendency towards Natural Science was brought about by his observation of the fossil plants of the roofing-shales of these coal mines. He made a large collection of these, and they formed the nucleus of the grand museum of Geology and Palæontology which he built up in later years for the School of Mines of Columbia College. Some of these specimens are still there preserved. He also was early

interested in mollusca and collected the land and fresh water shells industriously. I have been repeatedly surprised at his familiarity with shells, but it is true that there was scarcely any group of natural objects with which he was not conversant. He was, indeed, one of the "all-round" men of science, which the modern necessity for specialization has now made almost an impossibility.

His academic education was obtained at the Western Reserve College, from which he was graduated in 1846. He then undertook the study of medicine at the Cleveland Medical College, and received the degree of M. D. from that institution in 1848. The next two years of his life were spent in study abroad, especially in Paris, and in 1851 he returned to Cleveland and took up the practice of medicine, which he continued for about four years. During this period he was continually increasing his knowledge of geology, zoölogy and botany, and his fondness for these sciences was so great that when, in 1855, the opportunity was afforded him of joining one of the government expeditions then engaged in trans-continental surveys for the determination of the most available route for a Pacific Railroad, he gladly accepted the position of geologist and botanist to Lieut. Williamson's expedition to the Columbia River. The party sailed from New York on May 5, 1855, arrived at San Francisco May 30, and on July 9 were camped at Benicia ready to begin active operations, which commenced the following day. The route lay through Suisun, Marysville, up the valley of the Sacramento River to Fort Reading, thence to the Lower Klamath Lake on the northern boundary of California, the Upper Klamath Lake in Southern Oregon, through the Cascade Mountains during September, reaching the Columbia River, opposite the place where the city of Portland now stands, on October 9. Repeated trips of a few days each off the line of the main route were made, and large collections illustrating the natural history of the region were collected, accounts of all of which were published by Dr. Newberry in Lieut. Williamson's Report (Vol. vi. Rep. Expl. and Surv. from Miss. River to Pac. Ocean, 1857), the preparation of these accounts occupying his time for more than a year, during which he was located at Washington. Many of the plants collected came into the possession of Dr. Torrey, and are in the Columbia College Herbarium. Dr. Newberry's chapter

on the forest trees of Northern California and Oregon has become a classic in the literature of North American forestry.

Shortly after the completion of his work on this expedition he was attached to the party of Lieut. Jos. C. Ives which explored the Colorado River in 1857–1858, as physician and naturalist. The party assembled in San Francisco in the month of October, 1857, and sailed from that port November 1st, on a schooner for the mouth of the Colorado River. They passed Cape St. Lucas the seventh day out, but the progress of the vessel up the Gulf of California was so retarded by head winds that the point of destination was not reached until November 28. The vessel was unloaded during the next five days, and a start made up the river in a small steamboat which had been brought along. Fort Yuma, at the mouth of the Gila River, was reached on January 5, 1858, Bill William's Fork on February 1, the "Needles" near the mouth of the Mohave Cañon on February 7, that of the Black Cañon on March 8, and the Big Cañon early in April. They then left the river, ascended the Colorado Plateau and proceeded eastward past the San Francisco Mountains, reaching Fort Defiance on May 22, thence to Santa Fé and Fort Leavenworth, and then to the Atlantic Coast.

Dr. Newberry accumulated extensive collections on this expedition. He wrote the Geological Report. The plants were worked up by Drs. Gray, Torrey and Engelmann, and the Zoölogical Report was elaborated by Professor Baird.

In 1857 he was appointed Professor of Chemistry in the Columbian University, Washington, D. C., a position which he held, however, for a short time only.

In 1859 he was attached to the party of Capt. J. N. Macomb which traversed the region from Santa Fé to the junction of the Grand and Green Rivers of the Colorado of the West. The expedition set out from Santa Fé about the middle of July, and proceeded northwestwardly up the Rio Chama and across the divide to the headwaters of the San Juan River into southwestern Colorado and Utah, and back by another route to Santa Fé in the autumn. Dr. Newberry wrote the geological part of the report, which was, however, not published until 1876. It includes descriptions and figures of a large number of Triassic plants.

He became a member of the United States Sanitary Commission in June, 1861, and in September resigned from the army and accepted the Secretaryship of the Western Division of the Commission, with headquarters at Louisville, Ky. He held this very responsible position for five years, and during that time accomplished little work in Natural Science, beyond increasing his geological collections, which had now become very extensive.

On the establishment of the Chair of Geology and Palæontology, in the newly-founded School of Mines of Columbia College, in 1866, Dr. Newberry was elected Professor, a post which he held until his death. His private collection was purchased by the College, and liberal appropriations made for increasing it. These, together with the materials which he was continually collecting himself or receiving as donations or exchanges from other naturalists, have made the Geological Museum of Columbia second in importance to no other college museum in America. His long-continued, diligent and successful researches into fossil plants and fishes make this Museum especially strong in these two groups, it containing a very large number of type specimens, many of which are unique It is gratifying that these lines of investigation are to be followed up at Columbia by two of his students.

The Geological Professorship in the School of Mines necessitated the giving of especial prominence to instruction in Economic Geology, and the strengthening of the collections along that line. Much of Dr. Newberry's time was consequently occupied in this work, and his opinion on ore deposits, quarries and useful minerals generally, was highly prized. Calls to examine mining properties were far more numerous than he could answer, but during every vacation he traveled in one direction or another, so that every mining or quarrying district in North America became known to him. His beloved museum profited constantly during these years, both on the economic and the purely scientific side. He never regarded the economic interests as the primary object of his work, however, and a new genus of fossil plants or fishes was of far more interest to him than a new mine.

In 1869 Dr. Newberry accepted the Directorship of the Geological Survey of Ohio, and enthusiastically devoting all his lei-

sure time to the work, aided by a corps of competent assistants, brought together an enormous amount of information concerning the geology, palæontology, botany and zoölogy of the State which has been published in a series of thick octavo volumes. He also did considerable palæontological work for the Geological Survey of Illinois.

He was one of the judges of Building and Ornamental Stones at the Centennial Exhibition at Philadelphia, in 1876, and wrote the report thereon (Group I. pp. 107–171).

In 1884 he was appointed one of the palæontologists of the United States Geological Survey with especial reference to his favorite studies on fossil fishes and fossil plants. Two quarto fully illustrated monographs on fossil fishes, published in 1888 and 1889, and two yet unpublished monographs on fossil plants, resulted from this appointment.

In 1867 Dr. Newberry received the degree of LL. D. from his Alma Mater. He was an original member of the National Academy of Sciences; an original member of the American Association for the Advancement of Science, and its President in 1867–68; President of the New York Academy of Sciences from 1868 to 1892; President of the Torrey Botanical Club, 1880 to 1890; and a foreign member of the Geological Society of London, from which he received the Murchison Gold Medal for distinguished services to geological science, in 1888.

Dr. Newberry married Miss Sarah B. Gaylord in Cleveland, Ohio, in 1848, who, with six of their seven children, five sons and one daughter, survive him. His eldest son died some years ago.

In Botany the name of Newberry is commemorated in the genus *Newberrya*, Torr. Ann. Lyc. N. Y. viii. 55 (1864), of the Monotropeæ, which must, however, give way to the previously published *Hemitones*, A. Gray, Bot. Williamson's Exp. 80, Pl. XII. (1857). I have had the plate of this plant *Hemitones congesta*, A. Gray, *Newberrya congesta*, Torr., reproduced from the original, slightly reduced, and copies of it accompany this notice (Plate CXLII.) *N. spicata*, A. Gray, is another described species. Both are from the Pacific coast.

The following species have been named in his honor:

Physaria Newberryi, A. Gray, Rep. Bot. Ives' Exp. 6 (1861). = *Coulterina Newberryi*, Kuntze, Rev. Gen. Pl. 931 (1891). [Cruciferæ; living.]

Celastrophyllum Newberryanum Hollick, Amboy Clays, N. J., 153 Pl. XLVIII, figs. 1–27 (Ined). [Celastrineæ; Cretaceous.]

Astragalus Newberryi, A. Gray, Proc. Amer. Acad. xii. 55 (1876). [Leguminosæ; living.]

Potentilla Newberryi, A. Gray, Proc. Amer. Acad. vi. 532 (1865) *Ivesia gracilis*, T. & G.; Newb. in Bot. Williamson's Exp. 72, Pl. XI. (1857). [Rosaceæ; living.]

Peucedanum Newberryi, S. Wats. Amer. Nat. vii. 301 (1873) = *Ferula Newberryi*, S. Wats. Proc. Amer. Acad. xi. 145 (1876) = *Coloptera Newberryi*, Coult. & Rose, Rev. N. A. Umbel. 49. [Umbelliferæ; living.]

Viburnum Newberrianum, Ward, 6th Ann. Rep. Director U. S. Geol. Surv. 557 (name only), Pl. LXIV, figs. 10–12; Pl. LXV, figs. 1–3 (1885). Also described and figured in Bull. U. S. Geol. Surv. No. 37, "Types of the Laramie Flora," 113, 114, Pl. LVI, figs. 1–6 (1887). [Caprifoliaceæ; Laramie.]

Leptosyne Newberryi, A. Gray, Proc. Amer. Acad. vii. 358 (1868). = *Leptosyne Douglasii*, D. C. Prodr. v. 531 (1836). [Compositæ; living.]

Leucampyx Newberryi, A. Gray in Porter & Coulter, Fl. Colo. 77 (1876). [Compositæ; living.]

Gentiana Newberryi, A. Gray, Proc. Amer. Acad. xi. 84 (1876). [Gentianeæ; living.]

Pentstemon Newberryi, A. Gray, Bot. Williamson's Exp. 82, Pl. XIV. (1857) = *P. Menziesii*, var. *Newberryi*, A. Gray, Syn. Fl. N. A. ii. Part I. 259 (1878). [Scrophularineæ; living.]

Platanus Newberryana, Heer, in Capallini and Heer, Phyl. Cret. Nebrask. 16, Pl. I, f. 4 (1866). [Platanaceæ; Cretaceous.]

Agave Newberryi, Engelm. Trans. Acad. Sci. St. Louis, iii. 309 (1875). [Amaryllideæ; living.]

Cordaites Newberryi (Daws.), Knowlton, Proc. U. S. National Museum, xii. 607 (1890) = *Dadoxlyon Newberryi*, Dawson, Fos. Pl. Dev. & Sil. Canada, 14, Pl. I, figs. 7–9. [Gymnospermæ; Devonian.]

Cardiocarpon Newberryi, Andrews, Geol. Surv. of Ohio, ii. Pt. II, 425, Pl. XLVI, fig. 2 (1875). [Pteridophyta; Carboniferous.]

Notholæna Newberryi, D. C. Eaton, Bull. Torr. Bot. Club, iv. 12 (1873). [Filices; living.]

Goniopteris Newberriana, White and Fontaine, Rep. PP., Second Geol. Surv. Penna. 84, Pl. XXX, f. 2 (1880). [Filices; Carboniferous.]

Tæniopteris Newberriana, White and Fontaine, Rep. PP., Second Geol. Surv. Penna. 91, Pl. XXXIV, figs. 1–8 (1880). [Filices; Carboniferous.]

Odontopteris Newberryi, Lesq., Coal Flora of Penna., p. 127. [Filices; Carboniferous.]

Pseudopecopteris Newberryi, Lesq., Coal Flora of Penna., 202, Pl. XXXVII, fig. 1. [Filices; Carboniferous.]

Pecopteris Newberryi, Lesq., Geol. Surv. of Illinois, ii. 443 (1866) = *Sphenopteris Newberryi*, Lesq., Bobst. Journ. Nat. Hist. vi. 420 (1854) = *Diplothmena Newberryi*, Stur. Abh. K. K. Geol. Reichsanst, vii. 124 (1877). [Filices; Carboniferous.]

Archæophyton Newberryanum, Britton, Ann. N. Y. Acad. Sci. iv. 124 Pl. VII. (1888). [Alga; (?) Archæan].

Dictyophyton Newberryi, Hall. Sixteenth Annual Report of the Regents of the University of the State of New York, p. 87, Pl. IV., figs. 1–3, (1863). [Algæ; Silurian].

Fragilaria Newberryi, Ehrenb., Abh. K. K. Akad. Berlin, 1870, p. 56, Pl. III., fig. 12. [Diatomaceæ].

Archæophyton Newberrianum, Britton, Ann. N. Y. Acad. Sci. iv. 124, Pl. VII. (1888). [Alga; (?) Archæan.]

The following list of titles of his botanical writings is abstracted from a complete bibliography, prepared in the main by himself, recently revised by Prof. Jas. F. Kemp and Mr. Arthur Hollick, and published in the School of Mines Quarterly.

This bibliography includes 197 titles.

LIST OF BOTANICAL PUBLICATIONS OF PROFESSOR J. S. NEWBERRY.

"On the Structure and Affinities of Certain Fossil Plants of the Carboniferous Age."—Proc. Amer. Asso. 1853, 157; Annals of Science, i. 268.

"On the Carboniferous Flora of Ohio."—Proc. Amer. Asso. 1853, 163; Annals of Science, i. 280.

"Catalogue of the Fossil Plants of Ohio."—Annals of Science 1853, i. 95–106.

"New Fossil Plants from Ohio."—Annals of Science 1853, 116–128 and 153.

"The Botany of Northern California and Oregon."—United States Pacific Railroad Report, vi. Botanical Report, 1–94, sixteen plates (1857).

"Catalogue of Plants of Ohio."—Ohio Agric. Report and Reprint, pp. 41 (1859).

"Cretaceous and Tertiary Plants."—Hayden's Report on Exploration of Missouri and Yellowstone Rivers, 146 (1859–60).

"The Ancient Vegetation of North America."—Amer. Jour. Sci. xxix. 208 (1860).

"The American Cretaceous Flora."—Amer. Jour. Science, xxx. 273 (1860).

"Description of Fossil Plants Collected by the N. W. Boundary Commission."—Proc. Bost. Nat. Hist. Soc. vii. and Reprint, pp. 19 (1863).

"Report on the Fossil Plants Collected in China by Mr. Raphael Pumpelly."—Smithsonian Contributions, 1868, p. 119, Pl. I.

"Notes on the Later Extinct Floras of North America."—Annals Lyc. Nat. Hist. ix. 1, 1870, Reprint, 8vo. p. 76.

"Notice of Fossil Plants from the Cretaceous Sandstone of Fort Harker, Kansas, and from the Miocene of Bridge Creek, Oregon."—Proc. N. Y. Lyc. Nat. Hist. i. 148 (1870).

"Notice of Angiospermous Leaf-Impression in a Red Sandstone Boulder Found in Excavating the Foundations of a Gas Office in Williamsburg, L. I."—Proc. N. Y. Lyc. Nat. Hist. i. 149–150 (1871).

"Geological Survey of Ohio."—Vol. i. Part II. (1873), Description of Fossil Plants, pp. 355–385, eight plates.

"On the Results of the Removal of Forests."—Proc. N. Y. Lyc. Nat. Hist. Second Series, 31 (1873).

"On the So-called Land Plants of the Lower Silurian of Ohio."—Amer. Jour. Sci. II. viii. 110–160 (1874).

"Devices Employed in Nature for the Distribution of the Seeds of Plants."—Scientific American, May, 1879.

"Geological History of the North American Flora."—Bull. Torr. Bot. Club, vii. 74 (1880).

"On Cell Functions in Organic Structures."—Trans. N. Y. Acad. Sci. i. 42 (1881–2).

"Description of Fossil Plants from Western North America."—Proc. U. S. Nat. Museum, 1882, 502.

"Botany and Geology of the Country Bordering the Rio Grande."—Trans. N. Y. Acad. Sci. vii. 90 (1883).

"Notes on Fossil Plants from Northern China."—Amer. Jour. Sci. xxvi. 123 (1883).

"Notes on the Geology and Botany of the Country Bordering the Northern Pacific Railroad."—Annals N. Y. Acad. Sci. iii. (1884).

"Description of *Spiraxis*, a Peculiar Screw-like Fossil from the Chemung Rocks."—Annals N. Y. Acad. Sci. iii. (June, 1885).

"Saporta's Problematical Organisms of the Ancient Seas."—Review. Science (June 19, 1885).

"*Pinus monophylla*, Torrey and Fremont, a Variety of *P. edulis*."—Bull. Torr. Bot. Club, xii. 50 (1885).

"Flora of the Amboy Clays."—Bull. Torr. Bot. Club, xiii. 33 (1886).

"A New Species of *Bauhinia* from the Amboy Clays."—Bull. Torr. Bot. Club, xiii. 77, pl. 1 (1886).

"The Cretaceous Flora of North America."—Trans. N. Y. Acad. Sci. v. (February, 1886).

"*Pinus monophylla*, a Variety of *P. edulis*."—Second paper, Bull. Torr. Bot. Club, xiii. (October, 1886).

"The Ancestors of the Tulip Tree."—Bull. Torr. Bot. Club, xiv. (January, 1887).

"Food and Fibre Plants of the North American Indians."—Pop. Sci. Monthly, xxxii. 31 (1887).

"Fauna and Flora of the Trias of New Jersey and the Connecticut Valley."—Trans. N. Y. Acad. Sci. vi. 124 (1887).

"Fossil Fishes and Fossil Plants of the Triassic Rocks of New Jersey and the Connecticut Valley."—Monograph xiv. U. S. Geol. Surv. (1888).

"Triassic Plants from Honduras."—Trans. N. Y. Acad. Sci. vii. 113 (1888).

"Rhætic Plants from Honduras."—Amer. Jour. Sci. xxxvi. 342 (1888).

"The Laramie Group. Its Geological Relations, its Economic Importance and its Fauna and Flora."—Trans. N. Y. Acad. Sci. ix. 6 (1889).

"The Flora of the Great Falls Coal Field, Montana."—Amer. Jour. Sci. (III.) xli. 191–201, Pl. XIV. (1891).

The portrait accompanying this notice is reproduced from a photograph taken about 1886 and first published in Prof. H. F. Fairchild's "History of the New York Academy of Sciences." It is here used by permission.

Death of Isaac C. Martindale.

The readers of the BULLETIN will receive with deep sorrow the news of the sudden death of Isaac C. Martindale from apoplexy, at his home, No. 322 Penn street, Camden, N. J.

Mr. Martindale was born in Byberry, Philadelphia county, Pa., July 15, 1842. His parents were members of the Society of Friends, and his early education was acquired chiefly in schools under their control. His father was a descendant of John Martindell, who early settled in Bucks county, Pa. Many of the family have become prominent in the history of that region. His ancestry on both sides had shown literary ability which he inherited, while there was also in him an inherent love for nature. He began the study of natural history while on his father's farm, and in spite of of lack of books he acquired considerable scientific knowledge in all its departments. He left the farm to become a clerk in a bank at Byberry. In 1875 he was appointed Cashier of the National State Bank of Camden, the duties of which he performed with great fidelity. A few years ago some of his friends established the Camden National Bank, the cashiership of which was confided to him. He had been for the last three years Treasurer of the Academy of Natural Sciences in Philadelphia, a position in which his financial ability made him eminently useful.

The study of botany, in whatever hours he could snatch from his daily duties, was to him a welcome relaxation. He early made himself acquainted with the plants in the vicinity of Byberry. A

short tour in Europe in which his eyes were delighted by the mountain Flora of Switzerland, and during which he made considerable collections, enabled him to lay a foundation for that extensive Herbarium which was to be his chief life-work. After his removal to Camden, his close proximity to the rich and peculiar Flora of the "Jersey Pines" opened to him a new and most fascinating field, in the study of which he profited by the companionship and accurate local knowledge of the lamented Charles F. Parker. From that time onward, with most assiduous effort, most untiring industry, and with large pecuniary outlay, he devoted himself to the increase and perfection of an Herbarium which has few, if any rivals among the private collections in the land.

He published in November, 1879, in the American Naturalist, a list of plants collected on an excursion of some members of the American Association for the Advancement of Science to the vicinity of Pike's Peak in 1878, with critical notes on various species. In 1880 he read before the West New Jersey Surveyors' Association a paper entitled "Notes Upon the Bartram Oak" (*Quercus heterophylla*), with a summary of the literature concerning that mooted form. He published in the proceedings of the Philadelphia Academy for 1880, a short paper on "Sexual Variations in *Castanea Americana*." He also prepared a most valuable "list of the marine algæ hitherto observed on the coasts of New Jersey and Staten Island," which was published in the first volume of the Memoirs of the Torrey Club. For the proceedings of the Philadelphia Academy for November, 1883, he furnished a very just and feeling biographical sketch of his friend Charles F. Parker, who had died the previous September.

Although botany may be said to have been Mr. Martindale's chief love among the sciences, and that to which he had mainly devoted himself, it was by no means his exclusive hobby. Entomology received a large share of his attention, and as early as 1863 he was elected a corresponding member of the American Entomological Society. During his last years he devoted himself largely to the study of Lepidoptera, and had made a collection which experts in that department have pronounced as very nearly the finest in America. He was much interested in meteorology, and was for a time one of the observers for the Smithsonian In-

stitute, and had given much labor to the investigation of the history of his nativet own (Byberry), and to the study of his family genealogy.

It is remarkable that a man burdened with such exacting and responsible business cares, should have been able to accomplish so much in what were to him mere avocations, and botanists cannot help recalling the similar instances of Dr. Wm. Darlington and David Townsend, of West Chester, Pa., both bank officers, and both most ardent and successful botanists. And yet it is to be feared that Mr. Martindale overtaxed his strength, and perhaps had he shortened his hours of labor he might have been spared to the world for many years longer. Symptoms of failing health had led him to resign his position, within a week or two before his death, in order that he might find resoration by travel, and he had intended a visit to South America.

J. H. REDFIELD.

Anatomy as a Special Department of Botany.*

BY EMILY L. GREGORY.

The question of the exact limitation and relative importance of the various departments of botany is by no means a simple one. To verify this assertion it is necessary only to consider briefly the definitions given by some of the best writers of botanical text books. In our own country there is perhaps no higher authority than that of Asa Gray, who in his text book of 1857 says: Physiology is the study of the way a living being lives and grows and performs its various operations. The study of plants in this view is the province of Vegetable Physiology. The study of the form and structure of the organs or parts of the vegetable by which its operations are performed, is the province of Structural Botany. The two together constitute Physiological Botany," &c. The title page of the same book is headed "Gray's Lessons in Botany and Vegetable Physiology," and again in the text we find "Botany is the name of the science of the vegetable kingdom in general."

* Read before the American Association for the Advancement of Science, Rochester Meeting, 1892.

"The study of plants as to their kinds is the province of Systematic Botany, and finally, "Other departments come to view when, we consider plants in their relations to other things, as Geographical, Agricultural, Medical, Botany and the like."

By these definitions, vegetable physiology is not identical with physiological botany, for the latter is made to include vegetable physiology and structural botany, and the name of the book, "Lessons in Botany and Vegetable Physiology," implies that botany, does not include vegetable physiology. Again systematic botany is here made a distinct, separate department of equal rank with physiology and structural botany. However, if we examine closely into the practical outcome of these definitions, we shall find that except the inaccuracy of excluding vegetable physiology from the subject *botany*, they correspond with the manner of growth and development of these different departments in this country.

If Structual Botany is understood to include two parts, namely: the doctrine of external form and that of internal structure, it is easy to see in what sense Gray included structual in the province of Physiological Botany. The doctrine if the internal structure of plants, or Anatomy, is so closely connected with that of physiology, that to teach the elements of either successfully, both must be combined. It is probably not too much to say that in comparison with the progress made in the science of vegetable life in other countries, we are as yet not much beyond the elementary stage. Certainly we were not at the time Gray wrote the above definitions. At that date systematic botany occupied by far the most important place, and was therefore rightfuily ranked of equal if not of greater importance than the other branches. Also it was according to the normal method of developing a science to group together subjects less thoroughly understood and less studied under a general term whose exact meaning was not sharply defined, This term was physiology, or, as Gray puts it, physiological betany. There were then practically two divisions of the science, systematic and physiological botany, a more or less thorough knowledge of the former being necessary to a successful study of the lattar. This, though perhaps never before stated in so many words, was about the actual status of the subject at that

date. This book was revised in 1868 with no change in the definitions (?) In 1887 the "Lessons in Botany" were printed in which the definitions of the various branches of the subject correspond much more nearly to the present condition of the science. Even here there is a striking lack of definiteness and precision as compared with the definitions of the other later authors. For example, he says: "The study of the actions of plants, or of their parts, of the ways in which a plant lives, grows, and acts, is the province of physiological botany or vegetable physiology." Notice here the use of the two terms as identical. Pfeffer defines plant physiology as follows: "Physiology has the task, to find out exactly, according to measure and number, the processes which take place in an organism, to trace back these processes to their origin, and to learn their signification in the economy of the organism." The most restricted text book definition of the word physiology is probably that of Wiesner's, who says: "The province of physiology, using the term in its restricted sense, is to trace back all the phenomena of life to mechanical processes." Nothing could be more true and at the same time comprehensible than this. The only objection to it is, it is too restricted to cover what even Wiesner himself includes in his text book under the head of physiology in its restricted sense.

With the exception of this peculiar view of the province of physiology, Wiesner's definitions of the branches of the science very fairly represent the present accepted use of terms and manner of treatment. His exposition of the subject is briefly as follows: There are two branches which include the entire field of scientific botany, morphology and physiology. The first concerns itself entirely with the form relations of plants and their ports, the second with the conditions and phenomena of the life of the plant. Morphology is subdivided in four branches. 1. Descriptive morphology, or description of the outer form of organs; 2. The inner structure, or anatomy; 3. Development history, or tracing the development of plant, or organ; 4. Systematic morphology, or tracing the organs back to a few types.

Physiology is subdivided in two brances: 1. Physiology in its restricted sense as defined above; 2. Biology, or the consideration of vital processes, which cannot, at our present stage of knowledge be traced to any mechanical causes.

It is hoped a brief consideration of these views will bring us to our subject, anatomy as a special department of botany. In regard to the province of physiology the restriction made by Wiesner is by no means accepted by the majority of botanists. His use of the term biology is, I believe, peculiar to himself, as nearly all other German botanists and text book writers use it as including that part of botany which treats of certain phases in the life of plants which show most clearly the difference between lifeless and living matter; these are processes concerned in reproduction, in prolonging the life of the individual or species, and in short in the origin and end of living organisms. Accordlng to the present teaching, Pfeffer's definition of physiology covers the meaning, and to this may be added, that it is generally subdivided into physiology of nutrition and that of growth.

Taking up now the morphological side, it may be shown that Weisner's four branches may easily be reduced to two; Anatomy, which stands in close relation to Physiology; Systematic Morphology, holding the same relation to Systematic Botany. In this way the latter includes the three branches, descriptive morphology, development history, and the tracing organs back to a few types, which Weisner names Systematic Morphology, but which may be just as appropriately named Metamorphosis, leaving the term Systematic Morphology to represent the three combined.

Of these three, the first is too well known to require proof of its connection with Systematic Botany. The second has received very little attention frsm our botanists, and it may be of interest to explain briefly in what way it contributes to our knowledge of plant classification. Again quoting from Weisner, Development History is of service to Systematic Botany in two ways: First, by the examination of similar organs throughout all their phases of growth, their similarity is much more clearly shown than by simply studying them when fully grown, for example, leaves; dissimilar ones, on the other hand, appear more distinctly and sharply separate, as stem and root. Secondly, by the study of organs in all their phases of growth, the leaves, by which they develop, are made clear, and their probable relationships more easily determined than by the study of fully-developed organs and plants. The third branch, Metamorphosis, is plainly connected with classi-

fication, it is also equally evident that it does not represent a department of the science of the same grade as that of Anatomy.

Summing up these conclusions we practically return to the same position which Gray assumed so long ago. As a science, botany may be divided in two branches, morphology and physiology. Practically it is divided into systematic botany and physiology, or into two branches of such a character that one is and must be represented by systematic, the other by experimental and theoretical work. To illustrate more fully what is meant by this, as well as to substantiate the statement, one example may be given, the botanical work in the University of Berlin. It is well known that there are two departments about equal in rank, physiology and systematic botany. In the department of physiology, of which Prof. Scwendener is at the head, general botany is taught, that is, the different branches as above described as included under the head of scientific botany; the principal work, however, of this department is physiological and that of the highest order. In the other school, of which Prof. Engler has charge, systematic work forms the main line of study, and this is known as *special* botany. There is no other provision for special branches, except that which falls naturally into one or the other of these two provinces. Thus while the instruction given in both cases necessarily is not limited by close lines of definition, the work really shapes itself in two directions, and these two lines are those which represent at the present day, the natural divisions of the subject. As to their relative importance there is not the slightest room for discussion, as no physiologist can succeed without a fair knowledge of systematic botany, while the reverse is equally true.

These somewhat prolix statements of more or less familiar facts were thought necessary in order to define exactly the position which plant anatomy holds to the remaining branches, and its consequent relative importance. It holds a similar relation to physiology that morphological botany does to classification. It is no more possible to succeed in the investigation of questions now interesting the scientific world in the province of plant physiology, without a thorough knowledge of the minutest details of internal structure, than it is to take up questions of similar importance in the field of plant classification without a practical know-

ledge of that part of morphology on which classification mainly depends.

At the time Gray wrote his definitions as above quoted, this branch of the science was in its infancy; twenty years after this date, De Bary finished his text book on "The Comparative Anatomy of Phanerogams and Higher Cryptogams," which is now the standard authority on anatomical questions. Fifteen years have passed since De Bary's book was published, and during this time much progress has been made in this branch. Such progress in any department renders necessary a corresponding growth in text books and in methods of treatment. Whatever may be true of text books in general, it is believed safe to say that the English written text books of the day are singularly deficient in this respect. Abstruse and difficult physiological problems are introduced to students illy-prepared to handle them, while they try to meet the deficiency by a partial description of anatomical characteristics, a knowledge of which is necessary even to a comprehension of the questions. Not only must the standard of text books be raised, but the methods of instruction must be improved if we expect to cope successfully with some of the most interesting problems of the day.

For example, such subjects as twining stems, transmission of stimulus, nutation, and other intricate questions are often given to the students who have completed an elementary course in what we term type work, or sometimes, general botany, which includes a bird's-eye view of the various classes of plants with only the merest elements of anatomical training. Expensive pieces of apparatus are exhibited and their manner of working explained to students whose training is wholly inadequate to enable them to make an intelligent use of such apparatus.

Assuming the truth of our statements it is comparatively easy to find an explanation for this condition. Very few of our institutions of learning recognize the "Science of the Vegetable Kingdom" as a separate independent subject, and still fewer have any conception of its real nature, of its position in other countries, and of its importance in reference both to the practical and theoretical questions of the day. It is, however, not so easy in a limited space to show clearly in what manner anatomy is so closely

connected with physiology, and in this way to verify the statements made. One or two illustrations may be taken from the prominent discussions now occupying plant physiologists.

Anatomy may be divided into, or it consists of two parts, that of the cell, and that of tissues. In the study of the cell, for convenience, it is treated as wall and contents. With the contents as the seat of life, or Lebens-träger, are connected most of the questions concerning nutrition or the changes undergone in substance used as food. With the wall, as well as with certain parts of the contents, are connected questions of organized structure among which are some of the most absorbing interest and in whose solution some of the keenest thinkers of the time are employed.

Wiesner has recently published a book entitled "The Elementary Structure and Growth of Living Substance," in which he proposes a theory in several respects directly opposed to the accepted one which is known as the micellar theory of Naegeli. For example, according to the latter theory, the units of structure or micellae of organized matter are held together by the law of attraction and the cause of enlargement of such structures on taking in water is due to the penetration of water between the micellae of the substance composing the structure. According to Wiesner the units of structure are held together by fine protoplasmic strings, and as water is drawn away, by evaporation, the interstices between the units are filled with air; if water be added it is taken into the units themselves, which become enlarged proportionately; the change in volume caused by change in water contents depends, therefore, on change in the diameter of the units, and not on the lengthening or shortening of the protoplasmic strings.

Physiology treats of how a living organism grows and performs its various actions; this question, therefore, lies at the very foundation of physiology, as on it depends largely the manner of growth and other forms of motion. This will be seen by considering such subjects as the law of leaf position. Were Wiesner's theory the correct one, Schwendener's law, which is based upon Naegeli's theory would fall to the ground, and another reason must be sought in consonance with the facts. The position and authority of Wiesner is too well known to require mention here, and it is probably equally well known how strong are the arguments against most of the peculiar views which he advocates.

Other illustrations may be given to show the connection between a knowledge of the anatomy of tissues and that of their physiology. If a leaflet of the sensitive plant be touched in a certain way, it closes, and one after another all the remaining leaflets follow its example in regular order of succession. How is the effect communicated from the first leaf to the second and so on? This question has already occupied much time and energy in its attempted solution, but how can one hope to be able to add anything to that already known about it, without a thorough knowledge of the anatomy of the tissues through which the stimulus passes! Another more hackneyed subject, but even better than this as an illustration, is the so-called water question. If any one doubts the necessity of training in anatomy as requisite to physiological study, let him attempt to explain the present theory of the ascent of water through the trunks of high trees, to a person ignorant of plant anatomy.

In one of the editions of Gray's structural botany in speaking of the various departments of the science, he says: "A complete system of classification can only be made when our knowledge of all the other departments becomes complete." If this is the end toward which we are all striving, the importance of a proportionate and symmetrical development of the various branches can hardly be over-estimated.

Notes on Some Algæ in the Herbarium of the Long Island Historical Society.

By W. G. FARLOW.

Recently I received from Dr. Jelliffe some specimens of marine algæ from the collections of Mr. J. Hooper, Mr. Calverly and Col. Pike, now in the Herbarium of the Long Island Natural History Society, and since several of the species are scarcely to be found in other herbaria, the following notes may be of interest.

Of *Callithamnion Dietziæ*, Hooper, three specimens, were sent. That numbered 109 is the type specimen, and out of it was cut a piece which is now the only specimen of the species in the Harvey Collection in Trinity College, Dublin. Another specimen without

number marked merely *Call. Dietziæ*, Hooper, appears to be the same thing, although much faded and not in especially good condition. No. 108, however, called also *Dietziæ*, does not seem to me to belong to that species but to be rather *C. byssoideum*. The fourth specimen is marked "cum fructu." It is in reality sterile, and what was probably mistaken for fruit is nothing but the more densely colored chromatophor which is collected at the nodes. This specimen hardly can be referred to *Dietziæ*, although it is too young and undeveloped to enable one to say exactly to what species it belongs. The two specimens from Herb. Hooper and that in Herb. Harvey appear to be the only authentic originals in existence, and none of them have cystocarpic fruit. I have recently been able to examine again the specimen in Herb. Harvey, and although in my Marine Algæ of New England, p. 127, it did not seem to me that I was warranted in trusting to my memory in expressing a decided opinion on a specimen which I had not seen for several years, a recent reëxamination only confirms the opinion which I originally formed, viz: that *C. Dietziæ* is in reality a very slender form of *C. Baileyi*, Harvey, rather than a distinct species related to *C. corymbosum* and *C. versicolor*, the view adopted by Harvey in the Nereis, ii, 236. I have no doubt that several of my specimens of *C. Baileyi* var. *laxa*, collected at Wood's Holl are identical with the originals of *C. Dietziæ* in Herb. Hooper. The great variability of *C. Baileyi*, well known to all who have collected largely on the New England coast, would hardly be suspected by those who have seen merely herbarium specimens.

Two specimens marked *Fucus canaliculatus*, collected by Col. Pike, at Fort Hamilton and Astoria, were sent by Dr. Jelliffe. The specimens certainly had all the appearance of belonging to this species, although the conceptacles were so young that it was not possible for me to decide whether the structure was that of *Pelvetia*, in which genus the species is now placed by algologists. *P. canaliculatus* is a very common species of Europe, but has not yet been found with certainty in the United States. Whether it is possible that there is an error in localities as given by Col. Pike could, probably, be easily settled by Brooklyn algologists, for the species should be easily recognized at Fort Hamilton by collectors at the present time.

Ectocarpus Dietziæ, Harvey, and *E. Hooperi*, Harvey. Unfortunately, the originals of these two species in Herb. Hooper and Herb. Harvey are all sterile, and it is practically out of the question that future algologists should ever be able to recognize them again, there being nothing specifically characteristic in the sterile plants. All that one can say is, that of the two specimens of *E. Hooperi* in Herb. Hooper, one, No. 590, agrees with Harvey's figure in the Nereis in having short spinose ramuli, but No. 55 does not agree at all with the figure. Exactly what either of them is cannot be determined from the original specimens, and *E. Hooperi*, as well as *E. Dietziæ*, should be dropped from the list of known *Ectocarpi*. The original specimen of *Ectocarpus lutosus*, Harvey, from Herb. Hooper, shows that the specimens from Wood's Holl, mentioned in the Marine Algæ of New England, were correctly determined.

Codium tomentosum, Stackhouse.—A specimen of this species is labelled Greenport, L. I., but the locality needs confirmation. This alga is common in many parts of the world, and the New England coast is one of the comparatively few places where it is not known to occur. It appears more probable, seeing how commonly specimens of the species are found in collections, that there is an error in the label than that its presence in Long Island Sound should have escaped the observation of the numerous collectors in that region.

The specimens of *Wrangelia filicina*, Harvey, and *Hypnea Wurdemanni*, Harvey, are to be referred respectively to *Wrangelia penicillata* and *Eucheuma isiforme* as stated in the Nereis. The *Striaria attenuata* of Herb. Hooper is not that species, but *Dictyosiphon fæniculaceus*, Greville, and *Mesogloia multifida* from the same source is *Mesogloia divaricata* Kuetzing.

A Study of Solanaceous Anthracnoses.

The tomato, pepper and egg-plant are three vegetable fruits belonging, as is well-known, to the same family (Solanaceæ) of plants. Two anthracnoses are recorded upon the tomato, namely: *Glœosporium fomoides*, Sacc., and *Colletotrichum Lycoperseci*, Chest. The pepper has two also, *Glœosporium piperatum*, E. & E., and

Colletotrichum nigrum, E. & Hals. Upon the egg-plant are likewise two, the *Glœosporium Melongenæ*, E. & Hals., and a *Colletotrichum*, sp., found by the writer for the first time the past season in the trial plots of a large seed-grower, and, for reasons developed in this paper, remains unnamed as such.

It will be seen that there is a *Glœosporium* and a *Colletotrichum* upon each of the three Solanaceous plants.

By means of inoculations the *Glœosporium* of the tomato has been made to grow upon the egg-plant, and, what is of more interest, also upon the pear, banana, bean, quince and grape, while there was a mutual exchange effected with the apple; that is, the *Glœosporium fructigenum*, Berk., was successfully transferred to the tomato, as well as the native tomato *Glœosporinm* to the apple when it produced the true ripe-rot.

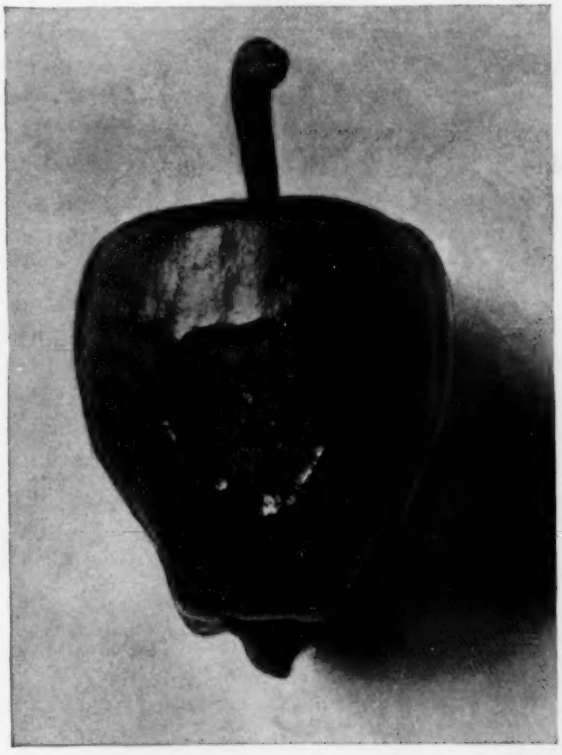
No attempts were made, from lack of proper virus at the time, to grow the egg-plant *Glœosporium* upon any other fruit. The pepper *Glœosporium*, however, was taken to the banana, pear, grape, persimmon, and a mutual exchange was made with the apple in the *Glœosporium fructigenum*, Berk. We have therefore, the ripe-rot of the apple thriving upon the tomato and the pepper, and it was grown also upon the egg-plant.

By an axiom it would seem to be concluded that the three species of *Glœosporium*, which have no real structural differences, and recorded for the three Solanaceous plants are reducible to one, and that that one is the old and familiar bitter-rot of the apple, namely; *Glœosporium fructigenum*, Berk. Three years ago Miss Southworth, while in the Division of Pathology of the Department of Agriculture, proved in a similar manner that this bitter-rot was identical with an anthracnose of the grape, and because the affected grapes were not bitter, but nearly mature when diseased, the name ripe-rot was proposed. This term is well adapted for the further expansion of the species, and the specific name of *fructigenum* given by Berkeley is almost prophetic.

The accompanying engraving was made from a photograph of one of the inoculations of the pepper ripe-rot germs from the apple. The appearance to the eye of the anthracnosed pepper was quite different from that of the apple, but the condition of flesh texture and character of the skin, etc., were very unlike,

which accounted for the more rapid growth in the pepper and the greater shrinking of the diseased area. However the microscopic structures were the same in both and the individual acervuli similar.

Less work was done with the *Colletotrichums* of the three plants under consideration because of lack of virus and of time



and opportunity to use it. The *Colletotrichum* of the egg-plant was easily grown upon the pepper. It also thrived upon the bean, producing pod-spots, and in turn the native Pod-spot Fungus (*Colletotrichum Lindemuthianum* S. & M.) was grown upon the egg-plant. This was a direct exchange and carries with it a double weight of proof. The *Colletotrichum* of the bean was grown upon the pear, and the one native to the pear flourished

upon the tomato. This one of the pear and the pod-spot *Colletotrichum* of the bean were at the same time introduced upon different areas of a citron, and the two in growing produced a blending anthracnose blotch made up of a single species of *Colletotrichum*. It is therefore shown that the chain of evidence is strong that all three of the Solanaceous plants are preyed upon by the same *Colletotrichum*, and that it is the one so familiar to truck growers as the pod-spot fungus, namely, *Colletotrichum Lindemuthianum*, S. & M. Whatever differences in appearance upon the various hosts there may be they seem entirely due to the varying conditions which attend the growth of the anthracnose. The microscope is not sufficent to distinguish from which host the fungus has been taken for inspection.

If these cultures give the true relation of the anthracnoses it is evident that the view now held by mycologists may need some modifications to fit the facts. In an economic aspect the information has its value as it shows a close connection between the anthracnoses of the several garden crops. That is, one fruit does not blight to its own kind alone. A decaying tomato or apple is neither its brother's nor its cousin's keeper.

BYRON D. HALSTED.

Two New Species of Mosses from Idaho.

BY J. B. LEIBERG.

(PLATES CXLIII.—CXLIV.)

DITRICHUM MONTANUM n. sp.—Plants cæspitulose, 1–2 cm. in length, fastigiately branching from the base, above more or less dichotomous. Monoicus, seldom synoicus; antheridia terminal on the apex of the basilar branches and of short axillary branchlets, few, without paraphyses; perigonial leaves 3–5, of two sorts, short, serrulate, concave, apiculate, costate, loosely areolate bracts, and longer, broadly costate, canaliculate ones, more compactly areolate, resembling the stem leaves but shorter, the two sorts occurring together, and now the one and now the other enclosing the antheridia.

Stem leaves erect or slightly curved, lanceolate below, channeled and subulate above with a narrow lamina of two to three rows of cells, subserrulate and inflexed margin of two rows of cells, apex coarsely toothed; costa broad, strong, ceasing below

the apex, above more or less concave on the upper face, convex on the back, flattened below; a row of parenchyma cells (Deuter) all around on the outside and a more or less continuous one through the centre of the costa, the sclerenchyma cells (Stereïden) very small and confined to the interior of the nerve; areolation above and in the middle of hyaline or chlorophyllose, thick-walled quadrate cells, rectangular below, yellowish at the insertion; outer perichaetial leaves similar to the stem leaves, the inner broadly sheathing. Pedicel pale yellow, 1.5–2.5 cm. long, usually twisted a few times when dry. Capsule 2–3 mm. in length, light orange or brown, red and narrowed at the mouth, erect, elliptical; when dry very much compressed laterally, with a few longitudinal wrinkles. Teeth of peristome cleft to the base into two semiterete equal segments, minutely papillose with a faint median line, rather obscured and distantly articulate, at the falling of the lid intertwisting and breaking away at the articulations, attached to a short, minutely-punctulate, protruding basilar membrane. Annulus double, narrow, dehiscent, of two rows of cells. Lid elongated, conical, reddish, ¼–⅓ the length of the capsule. Calyptra long, subulate, mostly persistent and falling with the lid, light greenish, the expanded portion narrow and about ⅓ the length of the capsule.*

Habitat.—On broken soil, upturned tree-roots, etc., in mountain regions at all elevations up to at least 8,000 feet. Kootenai Co., Idaho, J. B. Leiberg, No. 126, 1889; Suoqualmie Pass, Cascades, C. V. Piper, No. 119, August, 1891.

GRIMMIA PACHYPHYLLA, n. sp. § Rhabdogrimmia. In wide, dense, inflated mats, grayish or yellowish green above, dirty yellow or brown below, repeatedly dichotomous, subsimple plants intermixed, erect or sometimes ascending from a decumbent base, abundantly radiculose to above the primary innovations, robust, 5–12 cm. in height. Leaves closely imbricate when dry, spreading when moist and the upper portion more or less recurved, oblong or broadly lanceolate from an erect open

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* Specimens sent by me to J. Breidler, at Vienna, and compared by him with the type of *Ditrichum Knappii* (Jur.) at the Herbarium of the Hof-Museum differ from that type in the clearly-defined, smaller vein, the cells of the upper part of the leaf being larger and more quadrate, the margins incurved. This new species seems to be quite distinct from *D. pallidum*, though like it in its inflorescence and general appearance. E. G. BRITTON.

base, not clasping, shortly decurrent at the basal angles, carinate above and reflexed on the margins, strongly costate, the nerve pluri-stratose, more or less channeled, above becoming laminoid and gradually narrowing into a long straight or flexuous hair with a few weak salient or appressed teeth; cells of the areolation elongated-rectangular below, broader, subgraduate in the middle, small-graduate above, chlorophyllose, all sinuous and the cell walls very thick and dense and remarkably elastic; the margin of the leaf of two or three rows of nearly graduate cells, and the extreme base and decurrent angles of a few irregular, oblong or subrhombic, ones. Inflorescence dioicous; ♂ plants growing mixed with the ♀ usually somewhat shorter and more branched, occurring but sparingly; antheridial buds in the axils of the innovations, occasionally terminal on very short lateral branchlets, perigonial bracts 3–4, short, acute, thinly costate; cells of the upper half of the bract, narrow, short-rectangular or quadrate, sinuous, chlorophyllose, of the lower half broad-rectangular, straight, hyaline; antheridia large, numerous without paraphyses; archegonial inflorescence from secondary branches, sometimes direct from the axils of the innovations.

Capsule oval or oblong 2–5 mm. long, often two from the same perichætium, pendent on a twisted pedicel, 0.5–1 cm. in length, red and narrowed at the mouth, with a distinct collum, substrumose, at least when fresh and mature, erect when dry and pedicel more strongly twisted, longitudinally wrinkled, the ridges prominent, continuous or interrupted, 4–8 in number; perichætial leaves only sheathing to a little above the vaginule, otherwise similar to the stem leaves; lid red, subulate, ½–⅔ of the length of the capsule. Calyptra 4–5 lobed covering the lid only.

Teeth of peristome cleft to below the middle into two segments, sometimes merely lacunose along the median line, thin, minutely papillose above the middle when fresh, articulations few, incurved when dry. Annulus simple, of two rows of thin cells, narrow, strongly persistent, detaching in fragments.

Habitat granite, gneissoid and slate rocks throughout Kootenai Co., Idaho. J. B. Leiberg, No. 250, 1890–92. Characterized from living specimens.

A fine form of the Rhabdogrimmia section, most nearly related to *Grimmia decipiens* (Schultz), Lind., from which species it differs mainly in its dioicous inflorescence, its open leaf base, smoother hairy point, its broader basilar, its shorter medial, and its quadrate-

apical areolation, its pluri-stratose nerve, the longer beak of its lid, its narrow and persistent annulus, and the peristome incurved when dry.

EXPLANATION OF FIGURES.

(PLATE CXLIII.)

DITRICHUM MONTANUM, LEIBERG.

Fig. 1. Plant natural size.

Fig. 2. Capsule with lid and portion of pedicel.

Fig. 3. Calyptra.

Fig. 4. a. Cross-section of capsule at maturity; 4 b. same when old and dry.

Fig. 5. a. Peristome; 5. b. basilar membrane; 5. c. reticulation of capsule at mouth; 5. d. same near base.

Fig. 6. One of the sheathing perichætial leaves.

Fig. 7. Apex of leaf with margin rolled back; 7. a. fragment of upper one-third of leaf; 7. b. fragment of central portion of leaf; 7. c. same at base.

Fig. 8. Outline of a stem leaf.

Fig. 9. Two perigonial leaves with antheridia.

Fig. 10. a., 10. b. and 10. c. sections of the costa and portions of the lamina of a stem leaf.

Fig. 11. Fragment of leaf from near apex to show double row of marginal cells.

Fig. 12. Male bud.

All the figures, except No. 1, highly magnified.

(PLATE CXLIV.)

GRIMMIA PACHYPHYLLA, LEIBERG.

Fig. 1. A plant of natural size showing usual mode of branching.

Fig. 2. One of the sub-simple plants growing with the normal form of Fig. 1.

Fig. 3. Fragment of a branch showing usual position of antheridial inflorescence.

Fig. 4. Calyptra.

Fig. 5. Capsule and perichætium.

Fig. 6. The inner antheridial bract.

Fig. 7. An antheridium

Fig. 8. An old and dry capsule.

Fig. 9. A stem-leaf.

Fig. 10. Fragment of leaf margin from near apex of leaf.

Fig. 11. Upper areolation.

Fig. 12. Medial areolation.

Fig. 13. Basilar areolation, about $\times$ 450.

Fig. 14. Cells of the angles and extreme leaf base.

Fig. 15. Section, unprepared, from upper portion of leaf under low magnification.

Fig. 16. Section from middle of leaf treated with dilute nitric acid to bring into view the pluristratose charactor of costa.

Fig. 17. Hair point of leaf.

Fig. 18. Section from lower portion of leaf.

Fig. 19. Three of the teeth of the peristome with fragment of annulus.

All figures except 1 and 2 highly magnified.

Figs. 11, 12, 13 and 14 treated with hot dilute nitric acid to show true forms of cells.

Two New American Mosses.

By G. N. Best.

Buxbaumia Piperi, n. sp. Dioicous; stemless; leaves reduced to yellowish ovate-oblong or palmate, crenate-laciniate bracts; areolation oblong-hexagonal; bracts of fertile plants producing long rhizoids, enveloping the fleshy vaginale in a felt-like mass. Seta about 1 cm., arcuate or flexuose, warty, obliquely inserted. Capsule inclined, ovate-oblong, unsymmetric, greenish becoming pale yellow; section broadly elliptical; upper surface not deeply impressed nor strongly margined; neck distinct; cuticle thin, not glossy or but slightly so, rolling back in segments after the loosening of the broadly conical, obtuse operculum. Columella adherent. The membranaceous endostome composed of linear, papillose, hyaline, fluted segments, lightly cohering by their thickened margins, forming a truncated cone. Peristome of a single layer, with rudiments of a second deeply inserted; teeth linear, reddish or dirty white, papillose, articulated, revolute, lightly connate, fitting into the endostomial grooves, as long or nearly so as the segments. Pseudannulus usually of 3 layers, the inner showing traces of teeth more or less distinct. Spores of medium size.

Hab. On rotten wood, or on ground covered with woody debris, in mountainous regions, probably not rare in the North and West, but either overlooked or when found referred to *B. aphylla* or *B. indusiata*. Mason Co. Wash., Mr. C. V. Piper. Kootenai Co. Idaho, Mr. J. B. Leiberg. Bulletin xvii. 126; xviii. 49.

Remarks: *B. Piperi* is intermediate between *B. aphylla* and *B. indusiata*. The shorter and more curved pedicel, the more erect capsule not markedly depressed nor strongly margined, peristome of a single well developed layer, spores larger, readily separate it from the former. The more symmetrical capsule, peristome of 4 layers, the outer successively shorter, of *B. indusiata* mark it as distinct from the latter. In *B. aphylla* the operculum is usually thimble-shaped, the peristome rudimentary.

Not a little practice is required to manipulate the peristomes and endostomes of these peculiarly interesting plants with satis-

faction. The teeth, as soon as they are removed from the grooves of the endostome, in their upper two-thirds, curve outwardly so that their margins approximate, thus becoming obtusely triquetrous, the segments behaving in like manner.

DITRICHUM AMBIGUUM, n. sp. Dioicous; loosely cæspitose; stem rather stout, about 1 cm. long, arcuate-erect, with one or more innovations. Leaves pale yellow, shining, crispate when dry, accrescent upwards, lanceolate-subulate, patent-subsecund, flexuose; lower erect at the half-clasping short base, lanceolate; upper with oblong-erect bases, long lanceolate-subulate, concave, the slightly thickened-involute margins sinuate-dentate; the perichetial with longer sheathing bases, not abruptly narrowed: costa percurrent and dentate on the back in the upper third. Areolation linear, oblong, indistinct above; walls thick, tortuous, striate Seta reddish below, paler above, long, flexuose. Capsule cylindrical, 0.3 cm. long, narrow, straight or slightly curved, reddish, dark brown when deoperculate. Operculum conical-rostrate, blunt, nearly or quite erect, about one-third the length of the capsule. Exothecial cells quadrate-oblong, thick-walled, irregular with a row of smaller ovate-quadrate cells at the mouth. Teeth reddish, long, straight, papillose, nearly or quite split to the rather broad basal membrane; legs filiform except at the slightly flattened connate bases, equal and regular. Annulus large, adherent.

Habitat: moist banks. Mason Co., Washington, Mr. C. V. Piper.

Remarks: Somewhat larger and with firmer cells, yet the leaves of *D. ambiguum* bear a certain resemblance to those of the variable *D. tortile* (Schrad.) Hampe, the capsule and lid to *D. tenuifolium* (Schrad.) Lindb. (*Trichodon cylindricus*, Schimp.), while the peristome differs from that of either. In *D. tortile* the leaves are reflexed to the middle, the capsule oblong-cylindrical, the operculum conical, short-beaked, and the peristome of a more rudimentary type. In *D. tenuifolium* the exothecial cells are linear-rhomboidal, the teeth flattened to above the middle, roughened but not papillose,* the squarrose leaves abruptly narrowed, and the basal membrane not as wide. Notwithstanding the tortuloid peristome this moss is evidently a *Ditrichum*, most closely allied to *D. tenuifolium*, yet quite distinct.

ROSEMONT, N. J.

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* Braithwaite's British Moss Flora, i. 97.

The Fossil Aulisci of California.

By J. Deby.

It may be of interest to American microscopists to know that nearly one-third of all known species or forms of the Diatomaceous genus *Auliscus* are to be found in the fossil deposits of California. The Santa Monica and San Redondo earths are the richest localities in the world for these beautiful little forms. I add from personal observations, a list of the California known forms.

Auliscus antiquus, Ratt.
A. Biddulphia, Kitt.
Var. *prominens*, Ratt.
A. cælatus, Bail.
Var. *major*.
Var. *constricta*.
A. compositus, A. Sm.
A. decoratus, Ratt.
Var. *affinis*, Ratt.
A. elaboratus, Ralfs.
A. elegans, Ratt.
Var. *Californica*, A. Sm.
Var. *Grunowii*, Ratt.
A. eximius, Ratt.
A. gracillimus, Ratt.
A. Hardmanianus, Grev.
Var. *futilis*, Ratt.
Var. *bifurcata*, Ratt.
A. insignis, Cleve.
A. intestinalis, A. S.
A. Joynsonii, A. S.
A. Macræanus, Grev.
A. mirabilis, Grev.
A. ovalis, W. Arnott.
A. punctatus, Bail.
A. pruinosus, Bail.
A. sculptus, Ralfs.
A. speciosus, A. Sm.
A. Stockhardtii, Jan.—*A. racemosus*, Ralfs.
A. subreticulatus, Ratt.
A. subspeciosus, Ratt.,

besides a few undetermined and probably new forms seen by myself and by my friend, Dr. D. B. Ward, of Poughkeepsie, N. Y.

The above list comprises 31 named forms, all of which are in my collection, but out of which the Rev. Francis Wolle, in his Diatomaceæ of North America, only mentions 17, leaving 14 ignored. He, however, adds *A. incertus*, A. Sm. as from Santa Monica and A. *Peruvianus*, Grev. from "California," as fossil? He also mentions *A. mutabilis*, Grev. from Monterey, but no such species of Greville exists. Probably *A. mirabilis* was intended. It is seen from the above that 33 forms of *Aulisci* are at present known from the California diatomaceous deposits, which, during the earlier tertiary periods, must have been the veritable metropolis of the species of this interesting genus.

As I propose preparing a revision of the *Aulisci* in general, I should be glad to receive any additions to the above list from Californian localities, or the loan of any supposed new forms to be added to the existing ones.

31 Belsize Avenue,
London, N. W.

Notes on New Characeæ.

By T. F. Allen.

A new species of Nitella from the Valley of Mexico, collected in December, by Mr. Pringle, I decide to name *Nitella formosa.* It may be described concisely as Nitella diarthrodactyla, homoeophylla, monoica, flabellata, gymnocarpa, closely related to *N. tenuissima*, Kütz. It has the appearance of a gigantic *tenuissima*, attaining the size of 12 to 18 inches in length and diffusely branched. It differs, however, from *tenuissima*, not only as regards its size, but in that the fruit is subterminal only. The oospore is slightly larger than *tenuissima*, in the new species averaging about .340 mm. long by .305 mm. wide, with seven striæ. The membrane of the oospore is minutely granular, while that of *tenuissima* is covered with much coarser granules or reticulations.

I have also received from Japan a new *Nitella*, which is allied to our *Nitella oligospira*, and as in our species, the oogonium is single. The terminal extremities of the enveloping cells of the oospore become contracted, leaving spaces between the cells beneath the coronula of mature specimens; the oospore is .340 by

.285 mm., and its membrane is covered with conical elevations. This species I call *N. Japonica.*

A new variety of *Chara Hydropitys*, which I propose to call var. *Mexicana*, has been collected by Mr. Pringle. The stem and leaves are very slender, the stem .260 mm. diameter, the leaves .230 mm. in diameter. The leaves are ten in number in the verticil, with six or seven nodes, the lowest of which is naked: three or four of the nodes are corticated: there is usually one naked terminal with four or five bracts, like a tuft, all of equal size. The antheridium .245 mm. in diameter, the oospore .435 mm. long by .245 mm. wide, with nine or ten faint striæ. The spines on the stem are very small and scattered, broad at the base .040 mm. broad and .035 mm. long.

A new variety of *Chara gymnopitys*, to be known as var. *Keukenis*, from Lake Keuka in the State of New York. The cortex of the stem is irregular, the plants very small, and, from this locality, very much encrusted with lime. The oospore is .440 mm. long by .260 mm. wide, with nine very faint striæ. The antheridium is .300 mm. in diameter.

A Neglected Species of Hieracium.

By N. L. Britton.

(Plate CXLV.)

Hieracium Greenii, Porter and Britton, n. sp.

Pilosella spathulata, Sch. Bip. Flora, xlv. 439 (1862), not *H. spathulatum*, Sheel. *H. Marianum*, var. *spathulatum*, A. Gray, Syn. Fl. i. Part ii. 455 (1886).

Stem glabrous up to the branches, erect, rather slender, leafless or rarely with 1 or 2 leaves, 1½°–2½° high. Radical leaves tufted, ascending, broadly spathulate, oblong or obovate, obtuse at the apex, narrowed at the base, mostly petioled, glandular-denticulate or entire, villous-pubescent or somewhat hispid on both sides, 4′–7′ long, 1′–2′ wide; heads corymbose-paniculate, several or numerous, 30–40-flowered, rather slender-peduncled, 8″–10″ broad; peduncles and branches canescent-tomentose and glandular; involucre 5″ high, its bracts in 1 series, linear, acute, densely pilose and glandular; flowers bright yellow; achenes columnar, truncate; pappus not copious, brownish.

In dry soil, Tuscarora Mountain, Huntingdon Co., 1845 (Porter); Two-Top Mountain, Franklin Co., Penn., 1846 (Traill Green); Mountains of Clinton Co., Penn., 1842 (McMinn); Peaks of Otter, Virginia (Britton). May-June.

Differs from *H. venosum*, L., in its more elongated, villous-pubescent leaves, stouter stem, larger heads and very pilose and glandular, principal bracts of the involucre.

Differs from *H. Marianum*, Willd., in its entirely glabrous, leafless or very rarely 1–2-leaved stem, larger heads and pilose-glandular involucre.

Botanical Notes.

Note Explanatory—Several wide-awake botanists have noticed a mistake in nomenclature made in my article on "Orchids" in the February number of the BULLETIN, and uttered remonstrances. It is a good sign to see that innovators are held responsible for a strict application of their own principles, and I am quite ready to confess it when I go astray. On page 33, *Cathea*, of Salisbury, is substituted for *Calopogon*, of Robert Brown. This is entirely wrong if we follow the rules recently adopted at Rochester and accept the Species Plantarum of Linnæus of 1753 as our starting point. The name in that case should be *Limodorum tuberosum*, L. Sp. Pl. 950 (1753). The mistake in the text arose from a *lapsus emendationis*. That article was written before the Rochester meeting, and designed as a paper to be read before the A. A. A. S. Botanical Club. At that time I had taken Linnæus' first edition of the Genera (1737), as my starting point for genera, and under that rule *Cathea* would be correct. Unfortunately in the revision of the paper for the BULLETIN, I neglected to make the proper correction for this genus, although it was done in other parts of the same paper.

A word further may be said in regard to *Limodorum*. The deviation from the Linnæan name seems to have began with Swartz in 1799 (Act. Ups. vi. 78), who adopted it from Tournefort. He was followed by Willdenow in 1805 (Sp. Pl. iv. pt. i. 105), who called our plant *Cymbidium pulchellum*, and applied the name *Limodorum* mainly to various species of *Epidendrum*, which he separated from that genus. Subsequently L. C. Richard applied this

name to a single European species (*Orchis abortiva* L.), in which he has been followed by Bentham and Hooker. So far as I know, Michaux is the only botanist since the time of Swartz who has adhered to the Linnæan name *Limodorum tuberosum*. Everybody has followed in the wake of Brown and called the plant *Calopogon pulchellum*. THOMAS MORONG.

Note on Trifolium medium.—We received last July from Mr. Ira Parker, of Houlton, Me., some very interesting specimens of *Trifolium medium*, L. in which the heads were replaced by compound umbels, more or less completely formed. The specimens showed every gradation from compound umbels with very short pedicels to those with pedicels fully two inches long. The flowers were all pale, smaller than normal and apparently abortive.

Mr. Parker informs us that several stalks from the same root were similarly malformed. The tendency to vary in the direction of a compound umbel is an interesting confirmation of the general belief that the head is a sessile umbel. F. L. HARVEY.

ORONO, ME., JAN. 15, '93.

Variegation accounted for.—Last week some Callas were brought to me because of their peculiar construction and coloration. One stalk had, for example, a large spathe and two smaller ones within, thus constituting what is commonly known as a "double" calla. Another stalk had a "bloom" with the ordinary single spathe, but close to and enclosing it was a leaf that might at first be easily mistaken for the ordinary spathe. It, however, had a petiole of an inch in length, and the venation was strictly that of a calla leaf, while in color it was white with the exception of the tip and the outer border, which was green. A leaf separate from the examples above mentioned was also brought. It had the long petiole and the ordinary shape of a calla leaf, but fully a quarter of the central portion of the blade was white, and the etiolated part blended gradually with the surrounding green. The three samples gave the whole story of the intimate condition between the spathe and the ordinary calla leaf, and the "variegation" of the latter seemed only a result of a tendency to become a spathe in color, if not in shape. BYRON D. HALSTED.

RUTGERS COLLEGE, Jan. 27, 1893.

Reviews of Foreign Literature.

A Contribution to our Knowledge of Seedlings. By Sir John Lubbock, Bart., M. P., F. R. S., D. C. L., LL. D. (Kegan Paul, Trench, Trübner & Co., London, 1892).

Sir John Lubbock has in this work made a very important contribution to our knowledge of plants. The work occupies a field which has heretofore received comparatively little attention. Works upon systematic botany have been compiled repeatedly, until now Bentham and Hooker's "Genera Plantarum" may fairly be supposed to include nearly all the forms of spermaphytes entitled to stand as genera. In the meantime there remains much to be done in the way of research upon the life-histories of these plants, especially upon the structure of the embryo and its germination. It is into this field that Sir John Lubbock has pushed with characteristic vigor, and the result is this work "On Seedlings" in two volumes, and each volume of over 600 pages.

In the short preface the author briefly states the subject of his work, and mentions those who have assisted him in it. The first 77 pages are devoted to an introduction consisting of generalizations upon the several parts of the embryo both before and during germination. Following this are about 1119 pages, devoted, 1st, to seeds and their germination in the order as a whole, and 2d, a detailed description of the seed, their germination, and the seedlings of the species studied in the order. Species representing nearly every order in Bentham and Hooker's "Genera Plantarum" were studied. The arrangement of orders is the same as in that work, of which, indeed, this work on seedlings might well be considered a fitting supplement. The following are the orders in which the largest number of species were studied: Ranunculaceæ, 26 species; Cruciferæ, 57 sp.; Malvaceæ, 26 sp.; Leguminosæ, 95 sp.; Rosaceæ 22 sp.; Onagrarieæ, 20 sp.; Compositæ, 91 sp.; Labiatæ, 25 sp. A third part of the work is devoted to the bibliography of the subject in two divisions, 1st, general; 2d, special. Finally, a full index is appended.

The introduction is the part of the work that will excite most attention. Many facts are incorporated in it which have already been recorded, especially that part of the descriptions which detail the development and structure of the ovule and the position

of the parts of the embryo in the seed; yet the author has ventured to go farther than anyone before him, and has pointed out just how different forms of embryo have originated. This gives to the old facts a new charm. As the author informs us on the first page, these propositions have already been made in the "Jour. Linn. Soc. Vols. xxii.-xxiv.," and as he now reprints them, we feel assured that his confidence in his own interpretation of nature is not shaken by subsequent observation and reflection. All may not agree with him in his interpretations, but no one can question his accuracy of observation. It remains for his critics to draw conclusions which will harmonize better with the facts. Some of these propositions may be profitably mentioned.

1. The inversion of the ovule is of advantage to the plant in that it brings the micropyle in such a position as to increase the probability of fertilization. Here the author confirms the conclusions of others and promises "to enter into the question more fully on a future occasion." The writer of this review has suggested an entirely different explanation of this modification of the ovule and seed, i. e., that it is due to the advantage gained by the correlation of the parts of the embryo, to the external appendages of the seed, thereby securing a favorable position for the embryo during germination. (See "Science Vol. xx. No. 504, September 30, 1892.")

2. Unequal, unsymmetrical, lobed, and auricled cotyledons are to be explained by the crowding of the embryo in the seed, and its tendency to occupy all the available space within the coats.

3. The position of the embryo is often changed to accommodate its parts to the form of the seed. Embryos with accumbent and incumbent parts are, in many cases, thereby explained. "Now if from the form of the pods, or for any other reason, it is an advantage that the seed should be compressed, then the thickness of the cotyledons remaining the same, it is better that the radicle should be accumbent; while on the other hand, in a thicker or globular seed the incumbent arrangement is most convenient." In general, the author believes that the form of the seed determines the form of the embryo.

4. It seems desirable that the cotyledons should be raised above the surface of the ground. This leads to a correspondence between the length of the hypocotyl and the length of petiole of the coty-

ledons. The general rule is then "that the cotyledons are sessile when they are raised by the growth of the hypocotyl, while they are petiolate when they take their origin close to the ground." Connate petioles serve the purpose of forming a stronger support for the cotyledons than would be afforded if they remained separate.

5. Narrowness of the cotyledons or their division into narrow segments is attributed to the greater facility with which they may be withdrawn from the seed-coats. Also, narrowness of the cotyledons in some cases "enables the plant to make them lie conveniently in a globose seed."

The generalizations with which each order is introduced, are especially interesting and valuable. Here, as well as in the description of each species, the cotyledons are given prominence. The Onagrarieæ is as fair a choice among the orders as could be made. The seedlings of quite a number of its species have cotyledons in which a secondary growth occurs. The seedlings of *Œnothera Bistorta* are described as follows:

"Immediately after germination the cotyledons are oblong, obtuse, entire, sessile with a few long, scattered, glandular hairs, especially at the base. Hypocotyl with a few glandular hairs at the apex. Cotyledons often unequal, owing to their greater or less development in the seed, and one folding over the other.

"Six days after germination the base has become elongated, petiole-like, and glandular-pubescent, suddenly narrowed to a short petiole, or subsessile; the upper half remains rotund and glabrous except at the base and possibly a few short hairs underneath.

"Eight days after germination (fig. 367) they have elongated considerably, the upper true cotyledonary part enlarging, but otherwise remaining unaltered, while the foliar basal and narrow part has become linear, entire or sometimes with a minute tooth on either side, glandular-pubescent, suddenly narrowed at the very base.

"The lower portion elongates greatly, and the ultimate stage of the cotyledons (fig. 368) is linear, tapering at the base into a petiole; upper part or true cotyledon rotund or oval, entire glabrous, very short without midrib, lower part linear terminating abruptly in the upper part, tapering gradually to the base, with one or two minute and distant teeth on each side, thinly hairy,

greyish-green with an evident midrib sunk on the upper surface, and prominent beneath; petiole subterete, flattened above, very thinly hairy, or at length nearly glabrous.

"First eight leaves radical, alternate, linear, obtuse, tapering at the base into the petiole, thinly silky with appressed pubescence, minutely and distantly toothed at the margin, greyish green, more or less distinctly marked near the margin with black dots, with a very distinct, colorless mid-rib, flattened above, thinly hairy at the margins, colorless. (Thirty-four days after germination.)"

One of the striking features of the volumes to students especially interested in American plants, is the small number of North American species studied. Descriptions of seedlings of several garden vegetables are included. Among these, most prominent, perhaps, are the common radish (*Raphanus sativus*), common bean (*Phaseolus vulgaris*, tomato (*Lycopersicum esculentum*) and pepper (*Capsicum* sp.). Seedlings of many cultivated ornamental species are studied. Many of the species are rarely seen outside of Kew Gardens.

The author uses the old term "radicle" as a name for the axis of the embryo while in the seed, but steadily applies the word "hypocotyl" to the same organ during germination. The beginnings of the root-system of the plant is scarcely touched upon, although the origin of the first roots have been shown by Holm (Mem. Torr. Bot. Club. Vol. ii. No. 3) to determine in a considerable measure the habit of the plant.

The volumes are profusely illustrated with outline sketches.

All will agree, I think, that more such books are needed. It is only when as careful researches are made upon the life-histories of seed producing plants, as cryptogamic botanists find themselves obliged to make upon the lower plants, that we shall discover how much yet remains to be done to complete our knowledge of the Spermaphytes. There are many fields as inviting as was the one chosen by Sir John Lubbock. W. W. ROWLEE.

On the Simplest Form of Moss. Karl Goebel. (Ann. Bot. vi. 355–360, Plate XXII. 1892).

The author considers *Buxbaumia* an almost ideally simple moss, because the sexual organs are borne almost directly on the protonema, in this approaching the ferns. The protonema is said

to be similar to that of certain species of *Trichomanes*, and is compared with that of *Sphagnum*, *Andreæa* and *Metzgeriopsis*. The sporogonium is said to be most nearly allied to that of *Diphyscium*, and to possess no true seta, as the calyptra is ruptured by the expansion of the theca, and not by the elongation of the pedicel, as in the true Bryineæ. The plate illustrates the variation of the sporophylls in *Onoclea Struthiopteris*, and *Botrychium Lunaria*. The alliance with *Diphyscium* is contrary to the views of Lindberg and Braithwaite, though more in harmony with those of all the older authors, and most modern ones. Also the growth of the sexual organs upon the protonema, and the complexity and variability of the peristome would seem rather to indicate a higher organization.

The paper noticed above abounds in theories of the most slender probability, stated as ascertained facts. For example, in a paragraph of eleven lines (p. 357) the following propositions are given.

1. The organization of the sporogonium of *Buxbaumia* "is rudimentary as compared with that of the true Bryineæ."

2. "It somewhat recalls that of *Sphagnum* and *Andreæa*."

3. "It has no true seta, but merely an absorbent organ which penetrates into the rudimentary stem of the moss-plant."

4. "This organ gives off a number of rhizoids which absorb nourishment from the stem."

5. "Consequently in this form the calyptra is ruptured, not by the elongation of the seta as in the Bryineæ, but by the expansion of the theca of the sporogonium."

As Professor Goebel gives no reasons for his inferences, discussion is out of the question. The apparent statements of fact are contrary to the conditions observed in a recent study of *Buxbaumia*, which gives, in the main, the same results as those of Schimper, from whose descriptions and plates it appears that the capsule (especially of *B. indusiata*) is, if anything, the most complex of any of the mosses; the seta is entirely homologous with that of other mosses, does not give off rhizoids, but fits into a socket of the short stem, and ruptures the calyptra by elongation.

The fact that the marginal cells of the leaves of *Buxbaumia* grow out into long filaments is given as a reason for supposing hat the leaves of this genus are in some way more *protonemal*

than those of other mosses, regardless of the facts that *B. Javanica* has entire leaves, and that there are plenty of instances among mosses and hepaticæ where the marginal cells and even those of other parts of the leaf are produced into cilia. Indeed, Professor Goebel seems here to have undertaken a gratuitous labor, for all are agreed that the plant body in mosses and foliose hepaticæ grows from the protonema. The peculiarity of *Buxbaumia* in the respect seems to be that it does not grow so large.

The strangest thing about *Buxbaumia* is, perhaps, its physiological arrangement. The sexual generation, instead of leading the life of a parasite upon its parent, as in other mosses, is richly provided with chlorophyll, and apparently needs the parent only as a means of attachment to the substratum. O. F. Cook.

Bulletin de l'Herbier Boissier. Sous la Direction de Eugène Autran, Conservateur de l' Herbier. (Tome i. No. 1, 8vo. pp. 32, avec deux planches, Geneve, 1893).

We chronicle with much pleasure and interest, the appearance of another new journal, published under the auspices of the great herbarium of M. Boissier at Chambesy, near Geneva. It is planned to issue the Bulletin as material becomes available, and to produce a volume of 400 pages each year. The first number contains two papers: (I) Les Genres *Achatocarpus*, Triana et *Bosia*, L., et leur Place dans le Systeme Naturel by Dr. Hans Schinz and M. Autran, illustrated by two plates. *Achatocarpus* is a South American genus placed by Triana in relationship with *Rivina* in the Phytolacaceæ, where MM. Schinz and Autran conclude it belongs. It is referred by Bentham and Hooker to the Amarantaceæ and by Baillon to the Chenopodiaceæ. Four new species are described, all Paraguayan.

The second paper is by Dr. Geo. E. Post, and is Part V. of his descriptions of and notes on Syrian plants. N. L. B.

Proceedings of the Club.

TUESDAY, FEBRUARY 14TH, 1893.

The President in the chair and thirty-five persons present.

Mrs. L. Brück, of Hoboken, N. J., and Mr. Geo. M. Beringer, of Camden, N. J., were elected active members.

The assent of the Club was given to a proposition of the Council of the Scientific Alliance of New York, that a joint meeting be held in memory of Prof. John S. Newberry.

The first paper of the evening was then read by Dr. H. H. Rusby, entitled "Account of some new Species of Polypetalæ from Bolivia." The paper was a report upon the study of 280 numbers collected by Mr. Miguel Bang, representing 271 species and varieties, of which 58 were unknown and 4 others were represented only by manuscript names or by names published without descriptions. The specimens of these new species were exhibited, a number of them being compared with other specimens exhibited of related species. Dr. Rusby announced that his method of publishing his enumeration of Mr. Bang's plants would be in sets of 1000 numbers, each set being published in two parts, each part to constitute a number of the Memoirs of the Club. The first part, running through the Compositæ of the first thousand numbers, would occupy a number of the next volume of the Memoirs.

The second paper was then presented by Mr. Henry Kraemer, being his report as chairman of the Field Committee for 1892. The report was remarkably full in the enumeration of every detail connected with the work of the committee, and was filed with the Secretary.

Dr. Britton spoke of two forms of *Vaccinium vacillans*, collected at Forked River, N. J., and exhibiting two markedly distinct forms of corolla. His attempts to associate these with the corresponding fruits had not up to the present proven satisfactory. He also referred to the *Rubus villosus*, var. (?) *humifusus*, which had now turned up in a number of localities.

An interesting discussion followed on the appearance and habit of the *Nelumbo lutea*. Mr. Rudkin, in reply to a question by the President, stated that the plant had not only held its own at Swartzwood Pond, N. J., but had increased greatly. It was found in full bloom about the 1st of August. The flowers are 9 or 10 inches in diameter, and the petals are few and loose as compared with those of *Castalia*; the largest leaves are 2 feet or more in diameter. Dr. Morong remarked upon the great length and increasing thickness downward of the portion of the plant which was imbedded in the mud; in this respect it is similar to the *Orontium aquaticum*. So large and thick are these portions that

the plant bears removal very well, being capable of transportation to long distances.

Dr. Britton exhibited a copy of Prof. Conway Macmillan's "Metaspermæ of the Valley of the Minnesota," which he regarded as the most extensive and complete local flora ever produced. It is published by the Geological Survey of the State of Minnesota.

WEDNESDAY EVENING, FEBRUARY 22d.

Vice President Morong in the Chair and seventeen persons present.

The following papers were read:

"A Memorial of Professor John Strong Newberry," by N. L. Britton. The paper was illustrated by specimens of plants named in honor of Prof. Newberry and by a portrait, and is published in this number of the BULLETIN. Remarks were made by Dr. Arthur Mead Edwards, Mr. Lighthipe and the Chairman.

"Notes on some plants of the Yadkin River Valley, N. C.," by John K. Small. The paper was copiously illustrated by specimens and was discussed by Dr. Britton and Dr. Morong.

Index to Recent Literature Relating to American Botany.

Additions to the State (Indiana) Flora from Putnam County. Lucien M. Underwood (Proc. Ind. Acad. Sci. 1891, 89–91).

Eustichia Norvegica is reported from sandstone rocks at Fern, the fourth station in America.

Bread-Fruit Trees in North America. F. H. Knowlton (Science xxi. 24, 25).

The author traces the former existence of the genus *Artocarpus* through the North American continent to Greenland, in cretaceous and tertiary times, as evidenced by remains which are manifestly to be referred to this genus, although classed by different authors at various times under the genera *Myrica* and *Aralia*.

A. H.

Characeæ of America. T. F. Allen (Part II. Fascicle 1, large 8vo., p. 8, 14 plates; published by the author, 10 E. 36th St., New York).

The first part of Dr. Allen's work on our Characeæ was published several years ago. It deals with the morphology, life his-

tory and affinities of the group, their classification, and contains a tabular key for the identification of genera and species. This first installment of Part II. deals with eight species of *Nitella*, several of which are new. It is begun by a revised synoptical key to the thirteen species which Dr. Allen now has from America, five of which he has made known. Fourteen plates are issued with the fascicle, eight of them lithographs and six photogravures, made directly from herbarium specimens, and illustrating very well the habit and mode of branching of the plants. N. L. B.

Compositæ—Observations on the—II. Edward L. Greene (Erythea, i. 41–45).

Prof. Greene refers his recently proposed genus *Biolettia* to *Trichocoronis* and discusses *Eupatorium* and its allied genera.

Coniferæ—Notes on West American, I. J. G. Lemmon (Erythea, i. 48–52).

Mr. Lemmon describes his new varieties of *Pseudotsuga taxifolia*; one, var. *suberosa* from Arizona and New Mexico; the other, var. *elongata* from the base of Mt. Hood, Oregon. He also takes issue with Dr. M. T. Masters as to the common name of this tree, maintaining that it should be Douglas Spruce, not Douglas Fir.

Corky Excrescenses on the Stems of Zanthoxylum—The Nature and Development of. C. A. Barber (Annals of Botany, vi. No. 22)

The author first describes the development of the thorn at whose base the corky cushion always originates. The thorn is said to complete its growth during the first summer, growing from a zone of meristematic cells near its base. In the autumn begins the development of the cork-cells, probably from the same meristem which produced the cells of the thorn, though the author does not expressly state this. Yearly deposits of this cork-tissue are made which he compares to the annual rings of *Pinus* stems. As this cushion increases, the tissues near the base of the thorn gradually weaken; finally a rupture occurs by which it is detached, sometimes leaving a slight scar. In regard to the biological significance of this corky growth no explanation is attempted; as to determine this he says a careful study of the plants in their native surroundings is necessary. In some general notes on cork formation in thorns of different plants, several explanations of other authors are given. In conclusion, the author

gives a list of plants whose thorns have basal cork formation. This list is taken in part from Gamble's manual of Indian timbers and, in part, from specimens found in museums and botanical gardens.

E. L. G.

Crossing of Cucurbits, L. H. Pammel (Bull. 19, Iowa Exp. Station).

Prof. Pammel records the results of a large number of tests in crossing pumpkin (*Cucurbita Pepo*), squash (*C. maxima*), watermelon (*Citrellus vulgaris*), musk melons (*Cucumis Melo*), and cucumbers (*Cucumis sativus*). While there was great variability in some species as in the pumpkins and squashes, this was due to the seed used and not an immediate effect of crossing. The result of the cross is seen only in the offspring, not in the fruit.

B. D. H.

Cypripedium fasciculatum, var. *pusillum*. (Bot. Mag. t. 7275).

Dr. Hooker refers *C. pusillum* Rolfe, Kew. Bull., 1892, 211, to this species.

Distribution of Tropical Ferns in Peninsular Florida. Lucien M. Underwood. (Proc. Ind. Acad. Sci. 1891, 83–89).

Eclogæ Botanicæ, No. 1. Edward L. Greene. (Proc. Acad. Nat. Sci. Phila. 1892, 357–365; issued Feb. 6, 1893).

This contribution of Prof. Greene is devoted to (1) New or Noteworthy Thistles, in which the conclusion is expressed that all our species should be included in the Linnæan genus *Carduus*, the name *Cnicus* being applicable only to *Centaurea benedicta*. Most of the Eastern species have already been named under *Carduus*; the others are here transferred and ten new ones characterized, which will much facilitate the naming of undetermined material; (2) Three new Perennial Lupines: *Lupinus floribundus* from Colorado, *L. gracilentus* and *L. Covillei* from California. N. L. B.

Economic Fungi.—Fascicle V. Profs. Seymour and Earle. This contribution, embracing numbers 201 to 250, includes thirteen families of plants among the hosts, two of which, the Rosaceæ and Coniferæ are largely represented, the former containing the æcidial and the latter teleutosporic forms of several species of *Gymnosporangium*. The mycologist will be particularly interested in the specimens of *G. Bermudianum* (Farl.) Earle, which strangely has both the æcidial and teleutospore form upon the same galls

of the jimpson as found by Mr. Earle in Mississippi. Professor Galloway's new species, *Coleosporium Pini* is included and many other interesting Uredineæ. B. D. H.

Epidendrum spondianum (Bot. Mag. t. 7,273).
Native of Jamaica and Costa Rica.

Epigæa repens (Meehan's Month. iii. 17, 18; colored plate).

Flora of Mt. Orizaba. Henry E. Seaton. (Proc. Ind. Acad. Sci. 1891, 80–92).

Gases in Living Plants. J. C. Arthur. (Amer. Nat. xxvii. 1–8; 98–105).

Glumifloren des nordlichen Ohio. Edo. Classen. (Pharm. Rundsch. xi. 33–34).
A list of 70 Cyperaceæ and 78 Gramineæ from the northern counties of Ohio.

Grasses of Pennsylvania—List of the. Thos. C. Porter. (Leaflet, pp. 4).
A list of 166 species and varieties accompanying the exhibition of the specimens of Pennsylvania Grasses, prepared by Prof. Porter for the State Agricultural Societies exhibit at the Columbian Exposition.

Griselinia—Revision der Gattung. P. Taubert. (Engl. Bot. Jahr. xvi. 386–392).
Description of seven species of this New Zealand and South American genus of Myrtaceæ. We are interested in observing that Dr. Taubert adopts the parenthetical citation of previous authors.

Hardwoods of Oregon—The. Francis E. Lloyd. (Hardwood, iii. 10–11). Notes on fourteen species.

Lathyrus sylvestris. A New Fodder Plant. (Bull. 2, Va. Exp. Station.) The whole bulletin is given to the merits of this plant for fodder.

Malvaceen—Beitrage zur Systematik der. Max Gürke (Engler's Bot. Jahrb. xvi. 330–385).
A new treatment of the genera *Malachra* and *Urena.*

Morphological Notes. S. B. Parish (Erythea, i. 45–47; E. L. Greene, l. c. 52).

Description of lateral flowering in *Agave Americana*, and remarks on the nature of the petiolar glands in *Armeniaca vulgaris*, which, it is suggested, represent the petiolules of reduced leaflets.

Nematophycus Storriei, nov. sp. C. A. Barber (Ann. Bot. vi. 329–338, Pl. XIX. XX).

The plant originally described by Dawson as *Prototaxites*, from the Devonian rocks of Canada, and afterwards studied and renamed by Carruthers as *Nematophycus*, on account of its evident algal affinities, were made the subject of close microscopic examination by the author, in connection with specimens of *Pachytheca*. As a matter of interest it may be here noted that these genera, and *Chara*, are almost the only fossil algæ in which well defined structure is apparent, and the first two were long suspected to be merely parts of the same plants. The specimens of *Nematophycus* upon which the new species is founded, were obtained from the Tymawr quarry at Cardiff, Wales, in rocks of the Wenlock (Upper Silurian) age, associated with remains previously indentified as *Pachytheca*.

In addition to the full description of the new species a description is given, for the purposes of comparison, of *N. Logani* (Daw.) Carruthers, and in the plates both species are made the subjects of numerous studies in longitudinal and transverse sections.

A. H.

Occurrence of Certain Western Plants at Columbus, Ohio. Aug. D. Selby (Proc. Ind. Acad. Sci. 1891, 74–76).

Ornamental and Timber Trees. (Bul. 24, Minn. Exp. Station). This is a large work designed to encourage the growing of desirable plants adapted to the northern conditions. Full lists, in the notes for each sort, are given for deciduous trees, evergreen trees, shrubs, vines and climbing plants, herbaceous plants followed by tables of hardiness.

Palæobotany of the Cretaceous Formation on Staten Island—Additions to the. Arthur Hollick. (Reprint, Trans. N. Y. Acad. Sci. xii. 1–12, Pl. I–IV.) In this contribution the author supplements a previous contribution on the palæontology of the same region, but here giving special attention to the fossil plants. A list

of some forty species is given, in which, excluding seeds and fruits of uncertain affinities, there are seven new species described, viz: *Myrica Davisii*, *M. grandifolia*, *Platanus Aquehongensis*, *Kalmia Brittoniana*, *Acer minutus*, *Williamsonia* (*?*) *Riesii*, and *Phyllites poinsettioides*. All species enumerated are figured in the accompanying plates, and many of them are recognized as identical with the species described and figured by Prof. Heer from the Atane and Patoot beds of Greenland, by Prof. Leo Lesquereux from the Cretaceous of the Western United States, and by Ettingshausen and Velenoosky in Europe. Another important link in the chain of vegetation during Cretaceous times is thus established.

Pammel's Fungus of Texas Root-rot of Cotton—Method of obtaining pure cultures of. Geo. F. Atkinson (Bot. Gaz. xviii. 16–19).

Plant Dispersion by the Buffalo. (Erythea, i. 47, 48).

An anonymous letter is published, its author agreeing with the criticisms of Professor Green on a recent article on this subject.

Plantæ Lehmannianæ in Guatemala, Costa Rica, Columbia, Ecuador etc., collectæ.—Leguminosæ, Marc Micheli. (Engl. Bot. Jahrb. xvi, Heft. 3, Beiblatt, 1–9.)

An annotated list of a large number of species, all previously described.

Portulaccæ—A Rearrangement of American. Thomas Howell (Erythea, i. 29–41).

This valuable paper is in the nature of a synoptical revision of the American species of the order. Its principal feature is the proposal of a new genus, *Orcobroma*, including 10 species taken out of *Lewisia*, *Claytonia*, *Talinum* and *Calandrinia*, all acaulescent perennials with scapose stems jointed at the base and fleshy, edible roots.

Mr. Howell also refers a considerable number of the West Coast plants which have hitherto been in *Claytonia* to *Montia*, agreeing in this with the views recently expressed by Prof. Greene. *Calyptridium nudum*, Greene, is referred to *Spraguea*, and *Spraguea multiceps* is a new species. N. L. B.

Prolification und Phyllodie bei Geum rivale. E. Busherer (Ber. Deutsch. Bot. Gesell. x. 571–576; one plate).

Ranunculaceæ—A Comparative Study of the Roots of. Fred. B. Maxwell. (Bot. Gaz. xviii. 8–16; 41–47. Three plates).

Rio de La Plata; Its Basin, Geography and Inhabitants. Thomas Morong. (Bull. Amer. Geograph. Soc. xxiv. 479–509).

Delivered originally as a lecture before the American Geographical Society, and now printed as an article in its Bulletin, accompanied by a map of the region traversed. This is a running account of a trip made by the author up the rivers Plata, Parana and Paraguay in the year 1888, and a sojourn for the two following years at Asuncion, the capital of Paraguay. Brief descriptions are given of Montevideo, Buenos Aires and Asuncion, the manners of their inhabitants, the character of the pampas and campos, and the characteristics of the rivers and the vegetation upon their banks, ending with a short account of the wild tribes of Indians inhabiting the wilderness of the Gran Chaco in Paraguay.

Root-Pressure—An Apparatus for Determining the Periodicity of. M. B. Thomas (Proc. Ind. Acad. Sci. 1891, 82, 83).

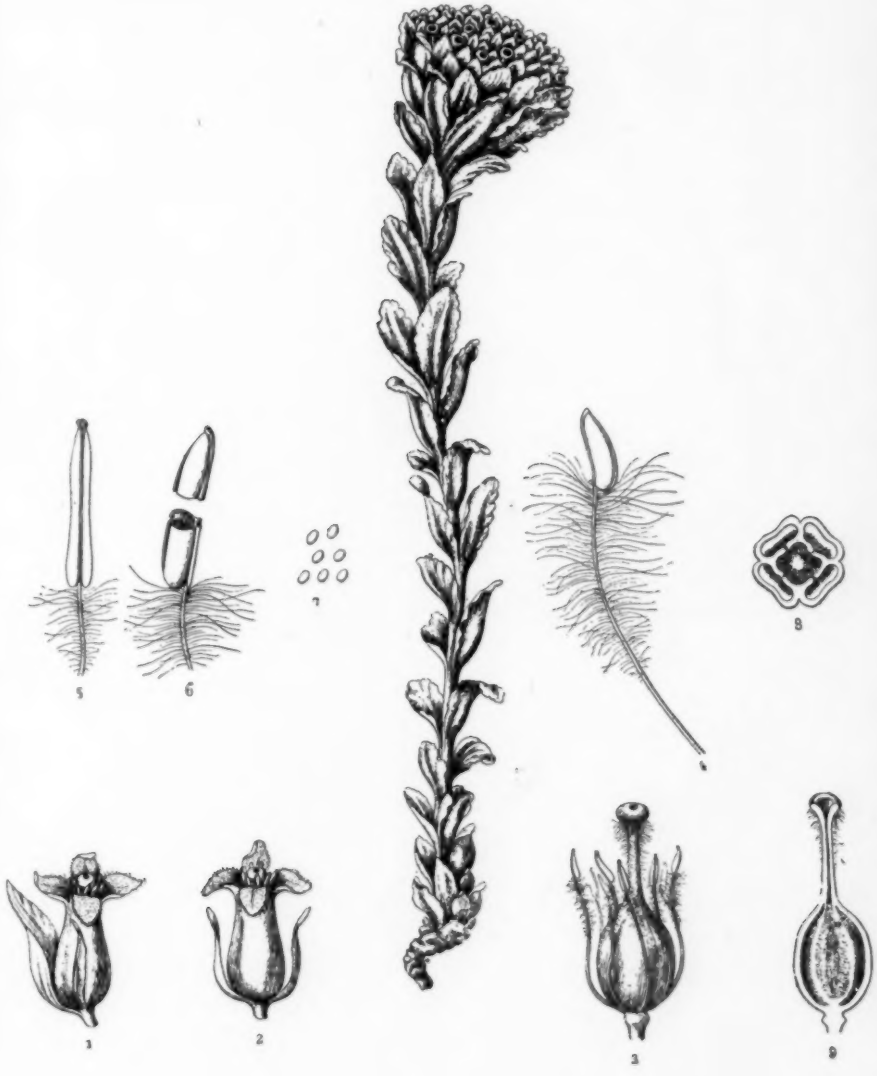
Root Rot of Alfalfa. (Bull. 22 Texas Exp. Station).

A new and serious trouble of fungous origin not yet well known on *Medicago sativa*.

Vacation in the Hawaiian Islands. D. H. Campbell. (Bot. Gaz. xvii. 410–416; xviii. 19–25).

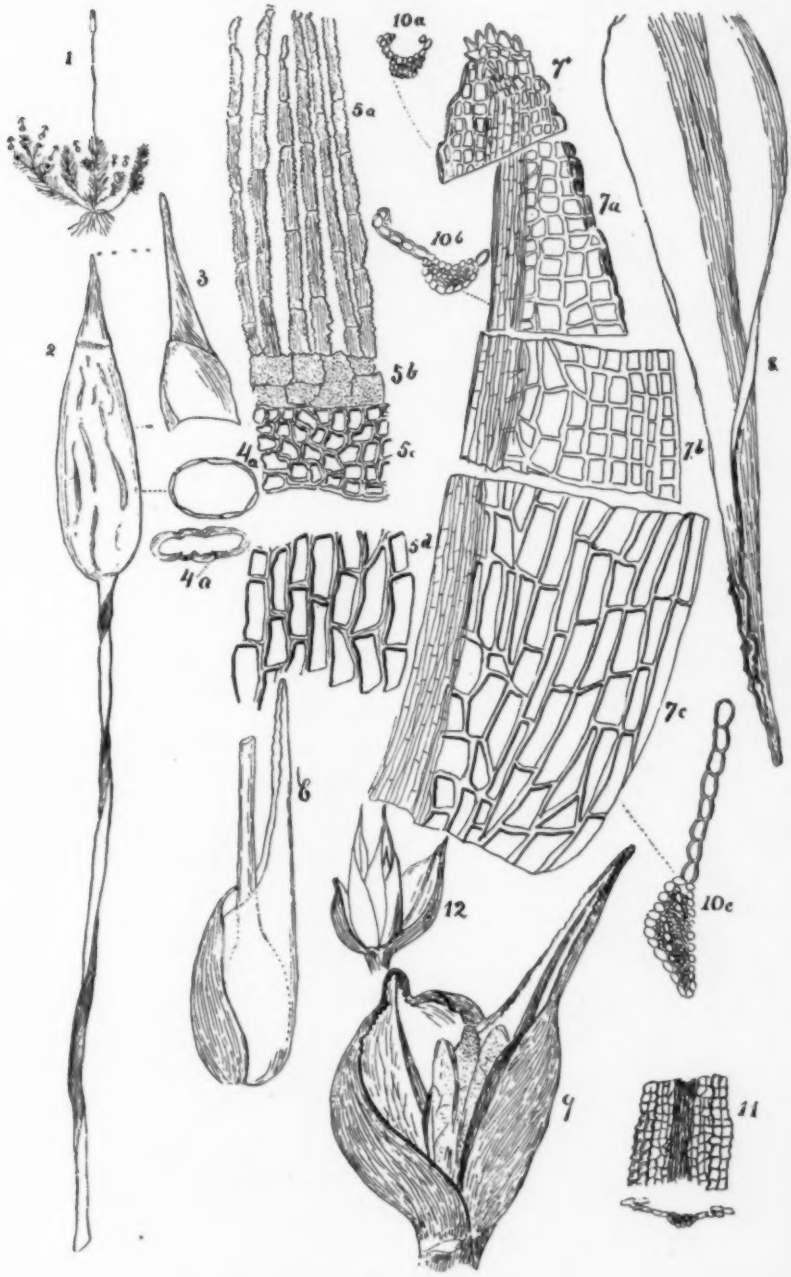
Violæ Chilenses.—Ein Beitrag zur Systematik der Gatting Viola. Karl Reiche. (Engl. Bot. Jahrb. xvi. 403–448).

A descriptive list of 46 species of Chilian Violets, several of which are new.

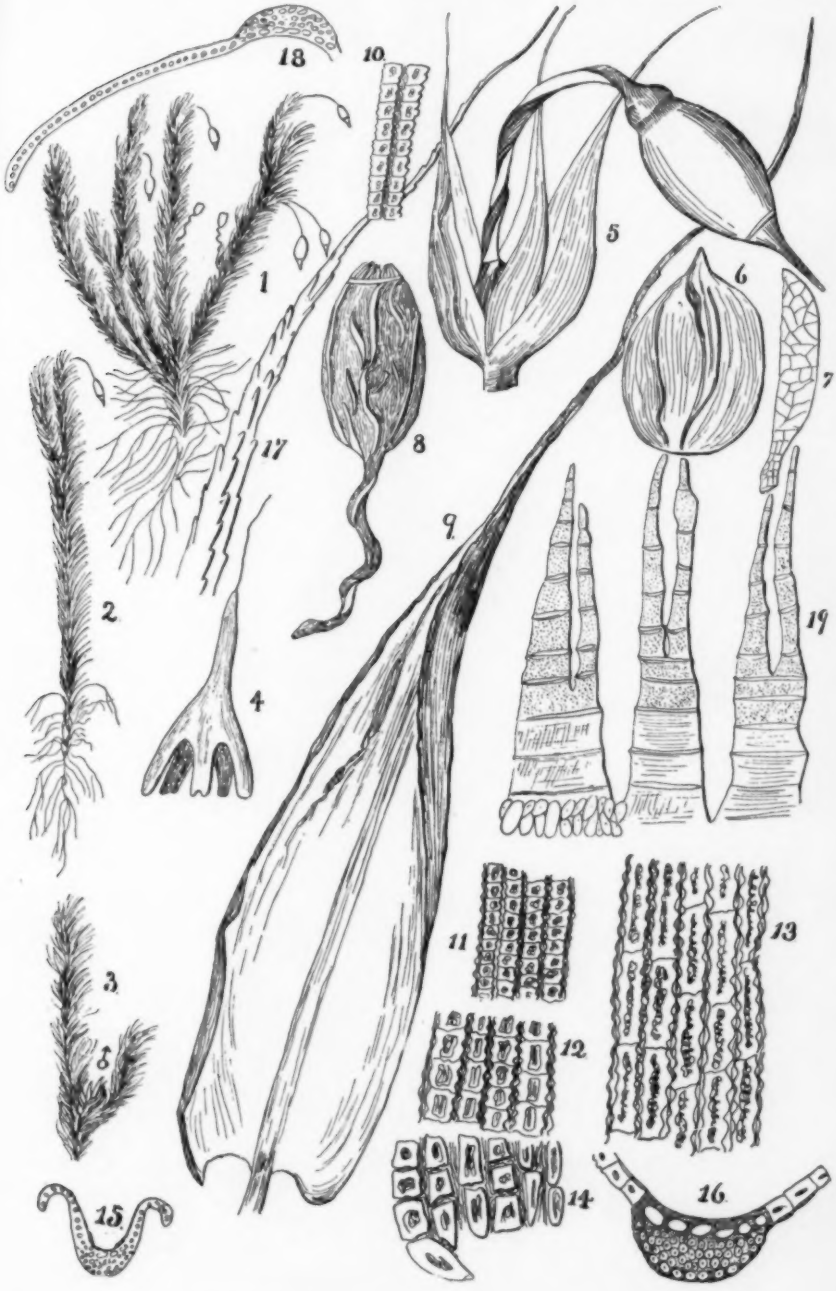


HEMITONES CONGESTA, A. GRAY.

NEWBERRYA CONGESTA, TORR.



DITRICHUM MONTANUM, LEIBERG.



GRIMMIA PACHYPHYLLA, LEIBERG.

HIERACIUM GREENII, PORTER AND BRITTON.